EM375 Project Handout
PROJECT OVERVIEW

OBJECTIVE: The aim of this project is for students to demonstrate several skills developed during the semester by solving a real-world engineering problem. The project is to use a launcher to fire a water balloon at the Professor, who will be standing between 100 and 200 feet from the launcher. The project requires proficiency in sample testing and analysis, computer modeling, data collection, data reduction, data analysis, and simulation.

PROJECT CONSTRAINTS: The following guidelines will be imposed on firing day:

1.   The full size slingshot will not be fired until the day of the competition.

2.   The actual distance to the target will not be known until just prior to the launch. The distance will be different for each team.

3.   A total of four shots will be allowed per team: One dummy (softball) and three water balloons.

4.   The first two balloon shots must be made using the firing solution curves developed during the project. Credit will be given for repeatability rather than absolute accuracy.

5.   The final shot can be adjusted to any parameters chosen by the team. Credit for this shot will be based on absolute accuracy.

6.   The only materials allowed on the "firing range" are the graphical firing solution curves developed by the team.

METHODOLOGY: Each team of students will develop a firing solution that relates the stretch of the slingshot and the firing angle to the distance the projectile will travel. In order to generate this firing solution, two basic tasks will have to be accomplished:

1.   Establish the relationship between the stretch in the slingshot and the launch speed of the balloon.

2.   Establish the relationship between the launch speed and angle, and the impact distance of the balloon.

By dividing the project into these two independent tasks, members of the team can work on the tasks simultaneously. One part of the group does not have to wait for information from the other part in order to do its job. This will allow the project to be completed in the short amount of time that is available.

For project management purposes, the two tasks listed above can be broken down into sub tasks as follows:

TASK 1
a. Determine the elastic properties of the slingshot tubing ("Rubbers Lab")
b. Generate firing solution plots that relate elongation to launch velocity

TASK 2
a. Develop a Mathcad simulation of the projectile problem
b. Use the scale model of the launcher to collect projectile problem data ("Measurements Lab")
c. Generate a firing solution plot that relates launch speed and angle to projectile distance.

DELIVERABLES: The following items will be delivered as part of this project:

1. Preliminary firing solution curves and the Mathcad worksheets (printed copies) used to make the curves. One copy per group.

   a. Graph of distance vs. launch speed. Three curves, one for each of three different launch angles.
   b. Graph of launch speed vs. stretch ratio.

2. The final firing solution curves from the project field day. These curves must be marked to show the solutions used for the first two shots.

3. One formal written report per group. See the separate handout for details.